The Imperial Forestry Institute University of Oxford

THIRTIETH ANNUAL REPORT

1953-54

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THIRTIETH ANNUAL REPORT OF THE IMPERIAL FORESTRY INSTITUTE ACADEMIC YEAR, 1953-54

Introduction. The year has not been marked by any unusual features for the Institute. The numbers of students may be considered rather below normal, particularly in the graduating class and in the research group, but there will be an increase next year. It is noteworthy that practically none of the new graduates sought employment either with the U.K. Forestry Commission or in the Colonial Forestry Service, but showed a preference for careers in private enterprise in Britain or Canada. It seems unlikely that this development will be so marked next year, but it will probably persist to some extent. There have been only minor changes in the staff of the Institute and the same is true for the teaching programme. Research in all sections has generally been following lines developing from previous work either in Oxford or at the field station on the Yorkshire moors. Progress has been quite satisfactory, various pieces of work having reached the writing up stage and publication; details are described under the Section Heads below, whilst publications are listed at the end of the Report.

Students. The number attending courses in the Institute throughout the year was 55. This total does not include 18 others reading the basic sciences in the University with the intention of proceeding to forestry.

Ten students were successful in the examination for the Forestry Degree, the classes obtained being one First, three Seconds and four Thirds, while two others were successful but were not classed having been too long in residence. Of these ten, one was a Colonial Forestry Probationer and returned to his Colony, one was a New Zealand Government Scholar and returned to New Zealand, one was a Government Scholar from Ceylon and returned to that country, one obtained a Canadian Industries Ltd. Fellowship in the Faculty of Forestry, University of British Columbia, one emigrated to Canada and is seeking employment with a timber firm there, one has obtained temporary employment with the Pest Control Research Station at Chesterford Park, Saffron Waldon, three have obtained employment with firms in Great Britain, and one is undertaking his National Service.

It is with deep regret that the death of one student of this class is recorded, at the early age of 24.

There were 16 students in the junior year, one of whom dropped out.

The Forest Officers' course was attended by 16 Officers of the Colonial Forest Service. They came from Nigeria (6), Tanganyika (3), Northern Rhodesia (2), Sierra Leone (1), Kenya (1), Uganda (1), North Borneo (1) and Fiji (1). One forestry graduate, whose home is in British Guiana, joined this course directly from Bangor University. He was in receipt of a Scholarship to enable him to take the post-graduate course before returning.

This year, only one Forest Officer from India (Bengal) and one from Pakistan (Punjab) attended the course arranged for them, but it is hoped that the number will increase again in future years.

Research Students. Two students submitted theses for the Diploma in Forestry. The subjects were 'A study of certain biological factors influencing forest soil formation' and 'The wood of some species of *Anisoptera*'.

Prizes. As it was impossible to decide between the merits of two of the Forest Officers who had attended the 1953/54 course, two Schlich Memorial Prizes were awarded. They went to Mr. J. E. F. Douay, Sierra Leone, and Mr. D. K. Paul, Fiji.

Instructional Tours (1) *The Introductory Tour in Britain,* for students about to start their forestry course and for those from overseas who are unfamiliar with British forests and forestry, was made just before Michaelmas term. The tour was conducted by Mr. Edwardson and joined by the Professor and Colonel Lloyd for part of the time. Forests visited included the State forests of the Dean, Tintern and Crychan, and the estate of Sir Richard Cotterell. Thanks are proffered to the Forestry Commission and Sir Richard for the facilities they provided for these visits. (2) *Western France.* Fifteen first year students, together with three Forest Officers from India, Pakistan and Australia, and a visitor to the Department from Southern Rhodesia visited the forests of Normandy and the Landes in April. The tour was conducted by Mr. Edwardson who afterwards, on his way to Freiburg, Germany, visited the Forest School at Zürich, where he discussed with Professor Leibundgut the possibility of a tour for the Forest Officers later in the year.

(3) *Western France and Switzerland.* As has become the custom, the senior students visited forests in the Vosges and Jura during the Easter Vacation. The tour was conducted by Dr. Jones.

(4) *Postgraduate Tour in Great Britain.* The Forest Officers together with two officers from India and Pakistan made a short tour in the Easter Vacation, under the leadership of the Professor and Mr. Edwardson. They visited the Forestry Commission areas at Brandon Depot and Thetford Chase and then inspected the Chestnut Coppices and Arboretum at Bedgebury in Kent. They saw National Trust beech woods at Slindon and rehabilitated areas under the Forestry Commission at Hursley and Weston Common. The tour also included a visit to the Crowborough Warren Estate of the Earl of Castle Stewart; thanks are given to the Earl for his courtesy in permitting the visit

and also to Mr. A. E. Aitkens, who showed the party round. The help of the several members of the Forestry Commission staff who devoted a considerable amount of time towards making the tour a success is greatly appreciated.

(5) *Switzerland.* Professor Dr. H. Leibundgut of the Eidg. Technische Hochschule, in consultation with Mr. Edwardson, arranged a tour for the Forest Officers. Dr. Grünig conducted the party which was led by the Professor and Mr. Brasnett, on visits to forests at Bern, Zürich, Lausanne, Aarau, Frauenfeld and Biel. This opportunity is taken of expressing our thanks for the very efficient organisation of the tour, and for the hospitality received.

Working Plans. The practical work was again carried out in the New Forest from the Forestry Commission hostel, Northerwood House, under the supervision of Mr. Brasnett, helped by Dr. Jones and Mr. Edwardson.

Utilisation Course. This year the students were divided into three parties, the senior undergraduates, the Forest Officers from West Africa, and the Forest Officers from East Africa and the East. Separate discussions and demonstrations were arranged for each by the Director of the Forest Products Research Laboratory. This arrangement proved popular, each man being able to study problems connected with his own area. Special thanks are due to the Director, and those members of his Staff who gave demonstrations, etc.

Vacation Practical Work. All undergraduate students are expected to carry out some practical work in the forests during Long Vacations. Four students found employment in Norway through the kindness of Mr. Ihlen, and five students worked in Canada. Arrangements for their employment were made by Dean Sisam of Toronto University and Mr. Leslie, Director of the Maple Forestry Station, Ontario. Other first year students worked on private estates in Great Britain.

Excursions. During the summer term, Forest Officers made excursions to Lord Bathurst's estate at Cirencester, the Forestry Commission Research Station at Alice Holt, the John Innes Horticultural Research Institution, and to Messrs. Glikstens' Timber Yards and Sawmills in London. The senior year students visited the woodlands of the Windsor Estate, the Duke of Bedford's Woburn Estate, the Forestry Commission Research Station at Alice Holt, and Forestry Commission woods at Bramshill. They also visited the Plumridge Sawmills, High Wycombe, to see some timber conversion and seasoning.

The junior year visited local woods in order to study silviculture and soils with Dr. Jones. Wytham Wood has again proved useful for demonstration purposes.

Thanks are tendered to all who permitted students to visit their woods and works.

Discussions. During Michaelmas and Hilary Terms, sixteen open discussions of forestry topics of general interest for Colonial Forest Officers were organised. Officers took it in turns to lead the discussions. During Trinity Term short papers on selected topics (usually

the Forest Officers 'Advanced Study') were read by the same group, each paper being followed by questions and discussion.

Seminars on Regeneration of Tropical Forests. Three seminars on this subject were arranged during Hilary Term as this method has been found preferable to lectures.

Visiting Lecturers. The usual series of invited lectures in Hilary and Trinity Terms were given with a different lecturer each week. These lectures are primarily for the post-graduate class, dealing mainly with problems not usually covered by the staff of the Department of Forestry. The lectures were followed by questions and discussions. The subjects dealt with were:

The Reproductive System and Plant Breeding. Professor C. D. Darlington, F.R.S.

Forest Tree Breeding. Mr. J. D. Matthews.

Extraction and transport of tropical timber, particularly in West Africa. Mr. J. Q. Wood.

Problems of game conservation in relation to forestry. Captain C. R. S. Pitman.

Primitive man in relation to the forest. Professor F. E. Zeuner, F.G.S., F.Z.S.

Origin of Tropical Rainfall. Dr. R. P. Beckinsale

Wood Pulp Industry in the Tropics. Mr. L. G. S. Hebbs, F.R.I.C.

Tropical Rain Forest Ecology. Professor P. W. Richards

Tsetse Control. Dr. K. R. S. Morris

Problems of Land Use Survey in the Tropics. Professor L. Dudley Stamp, C.B.E.

Ecological aspects of Land Utilisation in the Tropics. Mr. J. W. Purseglove.

The Nature Conservancy and its scientific work. Professor W. H. Pearsall.

The Timber Trade with particular reference to tropical colonial timber. Mr. Bryan Latham.

Principles underlying the use of exotics. Mr. R. F. Wood.

The administrative aspects of Soil Conservation. Mr. G. V. Jacks.

Assistance from other Departments, etc. Special courses in Surveying and Soil Science were given by members of these two Departments to the Forestry students. Mr. Hammersley, Graduate Assistant to the Lecturer in Design and Analysis of Scientific Experiment, and the University Lecturer in Colonial Agriculture (Mr. Masefield also gave courses to the senior year and post-graduate students. The Reader in Animal Ecology (Mr. Elton) arranged for two groups of post-graduate students to visit the Bureau of Animal Population in order to see the nature of the work being carried out and for discussion; this method was tried as an alternative to a course of lectures or seminars and proved very satisfactory. The thanks of the Department are extended to all lecturers concerned and the Heads of their Departments.

Immediately before the beginning of Michaelmas Term the staff of the Commonwealth Forestry Bureau gave a short introductory

course on documentation to members of the Colonial Forest Officers' course. The Director also gave a talk to all students on the organisation of the bureau for speedy and comprehensive collection and dissemination of information from all fields of forestry.

Assistance given to other Departments, etc. The Professor again lectured on Colonial Forestry to the Colonial Administrative Cadets at both Oxford and Cambridge and to the Colonial Agricultural Service Officers at the latter University. The Professor gave a broadcast talk on the Imperial Forestry Institute in a series entitled 'Places of Research' in the European Service of the B.B.C.

Staff Tours. No special tour was undertaken during the year, but Mr. Edwardson made a brief visit to Freiburg in Baden, to discuss problems of common interest with Professor Prodan.

Research Field Station. The Yorkshire station at Wykeham has again been used by members of the research staff. Acknowledgment is made of the help that continues to be given by the Silviculturist (North) of the Forestry Commission and by their Research Forester, Mr. Weatherell.

Scientific Societies, etc. Members of the staff have been active on the Councils and Committees of various societies, as in previous years.

Government Committees. The Professor continued to serve on the Forestry Commission's Advisory Research Committee, and the Colonial Office Committee for Colonial Agricultural, Animal Health and Forestry Research. Both the Professor and Mr. N .V. Brasnett serve on the Committee on Forestry of the Colonial Advisory Council of Agriculture, Animal Health and Forestry.

Senior Staff. There has been no change in the senior staff during the year.

Technical Staff. There are now eleven technical assistants for the eight laboratories, and three for the workshops; the Photographic and Artist's Sections are staffed by three technicians.

Secretarial Staff. There has been no significant change in the secretarial staff during the year.

WYTHAM WOODS

The plantations made during the past seven years continue to develop reasonably well though some of the older beech is disappointing despite much beating up: a major factor seems to be attack by voles. The first thinnings will probably be necessary next year as some of the larch planted with oak is likely to have to be removed in favour of the oak. Badgers caused continuous trouble in the maintenance of effective rabbit netting and steps had to be taken to reduce their number. The year's new area for planting again required a great deal of clearing but the use of a roller behind a tractor proved an effective method of dealing with the heavy growth of bracken. The planting stock used comprised 7,500 beech, 4,000 oak, 4,000 ash, 200 sweet chestnut and 700 spruce. The timber which remained unsold

last year was disposed of together with this year's fellings at a reasonable price in view of its relatively poor quality. It has still proved impossible to carry out the work prescribed for the Coppice Working Circle.

BAGLEY WOOD

After a further long delay due to the adjustments necessitated by the continued inadequacy of the labour supply, the working plan for Bagley Wood is in final draft and should be with the Forestry Commission early in the new Forest Year: the various field operations prescribed were carried out according to plan except for the storing of hardwood coppice which could not be undertaken owing to labour shortage. St. John's College is proposing to build two more houses at the Sawmill in the coming year which should help considerably in filling the vacancies for woodmen.

SILVICULTURE

During the year Dr. E. W. Jones gave the usual courses in silviculture and forest ecology to first and second year students and conducted practical classes in Bagley and Wytham Woods. Mr. T. E. Edwardson conducted the tour for the first year students in Western France and Dr. Jones took the tour for second year students in the French and Swiss Jura. Dr. Jones also demonstrated nursery techniques in the small plot of ground now available near the Institute, and conducted work for 10 days with the Working Plan Party in the New Forest in September 1953. In addition, Dr. Jones has completed his analysis of the result of the Cambridge University Botanical Expedition to Nigeria in 1947-8 and has prepared a paper embodying the conclusions drawn from them. It is hoped that this paper will be published within the next 18 months. A short account of some of this work was given at the Conference of the VIIIth International Botanical Congress in Paris.

Dr. Jones continued and completed an historical account and map of the Wytham Estate which it is hoped to publish shortly.

ECOLOGY

The Ecology course for the post-graduate students was again given by Dr. Dimbleby.

Field work this year has been restricted on account of preparations for the VIIIth International Botanical Congress in Paris, at which Dr. Dimbleby presented a paper on the effect of trees on heathland soils, and for the meeting of the British Association in Oxford in September, 1954. It has therefore been necessary to concentrate on laboratory work, and this has taken the form of continued research aimed at elucidating the constitution of the primary forest on base-poor soils before the impact of man converted the forest to heathland. A detailed study was made by pollen analysis of a Bronze Age barrow

on Hackness Moor in North East Yorkshire which showed that the change from scrub forest to extensive heathland occurred within the period of the Middle Bronze Age.

Parallel studies on soils buried by earthworks in the New Forest and Dorset revealed similar trends; in fact it proved possible to date a ploughed-out barrow by the ratio of the pollen counts of woody and non-woody species. We are not yet in a position, however, to do more than infer the probable composition of the primary forest. In particular, evidence relating to the structure of such forest is lacking and it may indeed be necessary to follow other lines of enquiry in order to obtain it. Unfortunately in Britain there is no truly undisturbed forest which can serve as a yardstick, but studies in the New Forest completed by J. M. Gill for a Diploma in Forestry serve to show that there is a distinction in structure between those woods which have followed heathland and those which are probably derived directly from primary forest.

Tree Physiology. Courses of lectures have been given in Physiology and in Soil Biology by Dr. L. Leyton. Experimental work has been continued both in the field and in the laboratory. In the field it has been found that shading the heath vegetation by means of wooden laths results in a marked stimulation to the growth of checked Sitka spruce: the response is undoubtedly due to the suppression of the heather and is associated with an increased supply of nitrogen to the trees. Work on the nutritional aspects of mulching with cut heather show that with Lawson's cypress, the increased growth resulting from this treatment is accompanied by considerable increases in the concentration of nitrogen and phosphorus in the needles. Details of both these experiments are being published.

In the laboratory, investigations are continuing into the effects of various environmental factors on the activity and growth of tree roots. The influence of the oxygen tension on the respiration of excised root tips of various tree species has been studied and new apparatus has been constructed to allow these measurements to be made on whole root systems. With the installation of a refrigerator unit, experiments can now be carried out over a range of temperatures. Investigations are also being made into the influence of oxygen tension on the rate of root elongation in seedlings. Aqueous extracts of various litters have been found to stimulate the oxygen uptake of excised pine roots and aseptic cultures have been set up to investigate the influence of these extracts on root growth. In one particular culture, forking of newly developed lateral roots similar to that associated with mycorrhiza has been obtained.

Microbiology. Studies on the events and processes occurring during the decomposition of litter from species whose litter shows considerable differences in rate of disappearance in the field were continued by Dr. W. R. C. Handley.

There are indications that the larger members of the soil fauna are to a large extent responsible for the differential rates of disappearance of the litter of various plant species in the field. These differential

rates of disappearance may well be related to differential rates of decomposition of the litter of different plant species but this has not yet been determined. The disappearance of the litter of different species showing a wide range of variation in rate of disappearance is being observed experimentally on a number of sites.

Field and laboratory observations indicate that the recently fallen litter of various plant species is not so frequently colonised by heavy fungal growth as often seems to be supposed. Various methods have been found whereby growth of strains of litter-destroying fungi can be obtained on recently fallen litter.

The litter from various species on a number of sites, and showing a variety of changes, is being collected at different times of the year and is being examined microscopically for the presence of micro-organisms inside the litter.

Preliminary attempts are being made to compare the digestibility of constituents of the litter of various plant species.

SOIL SCIENCE

As in previous years, the Reader in Soil Science, Dr. E. W. Russell, and Mr. R. G. Clarke, gave special undergraduate courses of lectures for forestry students, while Dr. Russell also gave a course on tropical soils.

Research. Mr. P. J. Rennie has nearly completed his investigations, involving over 500 soil profiles and 4 years of continuous measurements, on the effects of afforestation upon physico-chemical properties of North East Yorkshire moorland soils.

Evidence has been collected of a physical property of *Calluna, Erica-Scirpus* and *Eriophorum* raw humus that would appear to be of fundamental importance. A very small change in water content, equivalent to 0.5 inches of precipitation, makes the difference between a water content high enough to cause poor aeration, and a water content low enough to result in water deficiency for tree growth. This property, combined with the high water retentivity of the raw humus and the normal distribution of rain, explains the persistence of poor aeration in raw humus almost throughout the year on uncultivated moor soils of very varied mineral texture. A water impermeable mineral soil or horizon beneath the raw humus reduces the aeration still further. This almost continually poor aeration is considered to be one of the principal factors causing the retardation and failure of early tree growth on the uncultivated moor. Any factor reducing the aeration still further, such as heavier rainfall or basin topography, would intensify the retardation.

Deep ploughing provides immediately a rooting zone, (the buried raw humus), that is well aerated in both winter and summer. In plantations established without cultivation, this may be obtained only after canopy closure. However, ploughing and even a long period under a forest plantation, whether with coniferous or deciduous species, has only a very small effect on total soil porosity or structure,

so that the greatly improved aeration they cause, is always accompanied by a drastic reduction in the ' available ' water level in the main tree rooting zone. Mulching, by increasing the amount of available water, without also reducing the air content to the deficiency level, can reduce this disadvantageous effect.

Climatic records show a relatively high frequency of summer periods dry enough to deplete all available water from the raw humus and upper mineral horizons. This lower content of available water in the main rooting zone in summer, particularly in plantations of Japanese larch and Sitka spruce and older stands of Scots pine, shows the need to increase the depth of rooting.

These moorland soils of poor structure are thus unfavourable to tree growth primarily through their poor aeration in the uncultivated state and secondarily by their proneness to summer water deficiency in their afforested state. The intrinsic soil defects can, however, be overcome since early application of appropriate soil ameliorants to former *Calluna* moor soils has so deepened the rooting zone that both soil aeration and available water are adequate in winter and summer.

Extensive analytical work has been continued by Miss M. Lewis on materials from the 20 principal site types of the investigation and work on the interpretation of the soil nutrient availability data is in progress.

Natural *Calluna* moorland soils derived from a variety of geological formations show high acidity and low concentrations of available nutrients, particularly calcium and manganese. Of all horizons in these soils, the raw humus represents the most valuable source of available nutrients, particularly for calcium, phosphorus and manganese. The underlying bleached horizons constitute unfavourable rooting zones owing to their high soluble aluminium concentrations relative to calcium. Studies on former *Calluna* moor now supporting mature plantations and on soils supporting high quality class tree growth, suggest that the levels of available potassium and phosphorus in the natural *Calluna* moor do not seriously limit tree growth for many years after afforestation, but available and reserve calcium is outstandingly low in relation to the calcium demands of a timber crop. This suggests that the known decline in mature coniferous growth rate might be prevented by the application of calcium.

Prolonged growth of deciduous and coniferous species upon *Calluna* moor is associated respectively with a marked and slight increase in calcium concentration in the litter and upper raw humus horizons, but in both is accompanied by heavy litter production and increased depths of raw humus. As the pH of the deciduous litter is never higher than 3.7, the larger soil-mixing fauna are absent, so that a prolonged period under deciduous growth results in immobilisation of calcium in the surface layer quantitatively similar to that caused by the conifers. On these soils beech, birch and oak all appear unable even in 60—70 years to improve the soil to an extent that would justify their use in mixture with conifers or instead of them. On the other hand, the present method of growing pure coniferous crops, although

initially highly productive, rapidly depletes the already meagre calcium capital of the site, which unless compensated must ultimately lead to reduced production.

As no timber crop can be grown on these soils without making relatively heavy demands on certain nutrients, it would appear desirable to increase the amount of these nutrients in the soil well before their deficiency reduces timber production. Studies made in the area on soils which have been so treated indicate that the growth of the pioneer crop has been increased.

FOREST BOTANY

Mr. A. C. Hoyle continued as Curator of the Forest Herbarium; the rest of the senior Herbarium staff remained unchanged. Mr. F. White represented the Herbarium at the VIIIth International Botanical Congress held in Paris in July.

Teaching. Mr. Hoyle gave his usual courses in Systematic Botany and Ecology of Tropical Dry Woodlands, and materially assisted the preparation of a key to Meliaceous trees by a Sierra Leone Officer. The Herbarium was constantly used by senior students and forest officers, mostly under the supervision of Mr. White; among them, five worked on special subjects in Tropical Systematic Botany, and two did the first-year syllabus for the special paper in Regional Systematic Botany.

Regional and Advisory Work. Mr. Hoyle continued his study of *Brachystegia,* naming collections as received, and in particular made a special study of the West African species for the *Flora of West Tropical Africa* in which he is co-operating from time to time with Mr. R. W. J. Keay. Particularly gratifying was the opportunity of collaborating with Professor P. Duvigneaud of Brussels, who sent for identification his own and his colleagues' *Brachystegia* collections from little known areas of the Belgian Congo. Mr. Hoyle also continued his collaboration with Mr. J. K. Jackson of the Sudan Forest Department who spent some time working in the Herbarium. Miss M. E. Griffiths, Herbarium Assistant, started work on *The Taxonomy and Ecology of the African Species of Terminalia* for a B.Sc. thesis. The detailed investigations of Mr. Angus and Mr. White on special groups were largely in abeyance because of the great demands on time made by the Northern Rhodesian Check-List. Mr. White continued to represent the Institute on the British Standards Committee for the nomenclature of hardwood timbers and spent an appreciable amount of time revising the forthcoming list B.S. 881.

Northern Rhodesian Check-List. During the first half of the academic year, mounting and naming of the large collections made by Messrs. Hoyle, Angus and White was continued. In January 1954 the writing of the final draft was started, and by the end of July, 551 species belonging mainly to the most difficult groups had been dealt with.

Visitors and Enquiries. Visitors who worked for short periods in the Herbarium were Miss E. A. Bruce from Kew, Dr. J. Leonard and Professor P. Duvigneaud from Brussels, Dr. P. J. Greenway from Nairobi and Mr. R. M. Lawton from the Gold Coast; there were many other visitors with enquiries. An unusually large number of requests for identification and enquiries came from the Forest Products Research Laboratory and their correspondents.

The year was especially noteworthy for the very successful second Congress of the *Association pour l'Etude taxonomique de la Flore de l'Afrique tropicale* held in the Departments of Botany and Forestry at the end of September 1953, resulting from Mr. Hoyle's invitation extended at the first Congress in Brussels in 1951. Many of the distinguished visitors contributed valuable papers, some of them illustrated with excellent lantern slides. Mr. White contributed a paper on *Distribution of the African Species of Diospyros,* which will be published shortly in the Italian journal *Webbia.* International co-operation for the preparation of an accurate vegetation map of Tropical Africa was secured, and Professor Duvigneaud outlined a scheme for making available a new African bibliography of which the first publication has since appeared.

Forest Herbarium. There was a gratifying increase in the number of specimens mounted, 3503 sheets as against 1492 last year, reflecting improvement in efficiency after some changes in staff. Part of the accumulation due to the large collections made in E. Africa and N. Rhodesia in recent years is thus being reduced.

Specimens submitted for identification numbered 5,272, mainly from the *Université Libre,* Brussels, the Government Herbarium, Salisbury, Southern Rhodesia, and the Forest Departments of the Gold Coast, Nyasaland, Sierra Leone, Sudan and Uganda. Named duplicates received amounted to 796 numbers and came mainly from the East African Herbarium, the Missouri Botanic Garden, the Government Herbarium of Southern Rhodesia and the Forest Herbarium, Nigeria.

The number of identifications and corrections sent out totalled 664. Many of the corrections were due to Mr. Keay's careful study of Forest Herbarium material in connection with his work on the *Flora of West Tropical Africa.* The following territories received identifications: Bechuanaland (11), Gold Coast (148), Nigeria (150), Nyasaland (86), Northern Rhodesia (100), Sierra Leone (23), Sudan (11), Tanganyika Territory (83) and Uganda (36).

FOREST PATHOLOGY

Mr. W. R. Day continued in charge of the section, with Mr. F. H. Jones (Chief Technical Assistant for the Institute as a whole) as senior assistant, and Mr. D. K. Barrett. Miss H. M. Penn replaced Miss J. Rose who resigned.

Teaching. The usual courses of instruction were given for the Honour School and the post-graduate students.

Visit to Canada. At the invitation of the Ontario Research Council an address was given at Maple, Ontario, at their autumn conference on Forest Pathology: the subject was 'Soil conditions in relation to the development of root disease and decay in the forest'. At the invitation of the Faculties of Forestry and Botany, in the University of Toronto, two lectures were also given on 'Forest Hygiene in Great Britain'. These lectures are to be published as a Bulletin by the Faculty of Forestry.

By the courtesy of the Provincial Forest Service and of Toronto University, a visit was paid to the Government research station at Petawawa and to the University forest at Dorset.

Research (1) *Cambial injuries on the main stems of conifers.* At the request of the Conservator, the dying of bark on Douglas fir was examined in Dymock Forest, near Ross-on-Wye. This phenomenon has been known for some years and has been observed fairly widely, although except very locally, it has never been prevalent enough to be considered important. The symptoms are that larger or smaller patches of dead bark occur on the main stem, usually, but not always, accompanied by abundant resin flow. A tentative conclusion, after several visits to the affected area and of careful anatomical examination of material, is that the dying of the bark takes place as the result of water deficiency in the cambial region. Death may occur at any time from the onset of the formation of new wood in the spring until the end of the formation of early wood, probably sometime in early July. The parts which die commonly show collapse (radial splitting with tangential crumpling) of the meristematic region and the inner phloem: zones of abnormal tissue which consists of various types of parenchyma and of traumatic resin ducts appear where the cambium is affected but not killed. A point at which injury first occurs is at the base of live branches; but the more extensive areas of dead bark occur on the lower part of the main stem. This phenomenon has been noted in Douglas fir plantations which are in high canopy and up to 25 to 30 years of age.

It is interesting that the dying of bark on the lower part of the main stem of Sitka spruce in Glentress Forest, referred to in last year's report, is accompanied by anatomical symptoms similar to those seen in the Dymock Douglas fir and the indications are that this too is associated with a deficiency in water supply to the cambium. Similar examples on Sitka spruce have been seen elsewhere, though not examined in detail, and it is not improbable that other species of tree are also affected.

A reduction in density of foliage and the development of root disease seems usually to accompany this bark disease. This was seen particularly plainly at Dymock and is probably always to be expected to a greater or less extent. Hitherto this behaviour has only been found in plantations growing on moderately or highly fertile soils in which the rooting space is unduly limited and the subsoil unfavourable as a source of water supply. It is plain that this is a phenomenon requiring much further research.

The possibility that infections may act as complicating factors has not been forgotten, but so far no parasite of primary importance has been discovered. It is to be noted, however, that *Armillaria mellea* occurs to some extent in Dymock Forest on the Douglas fir and *Fomes annosus* on the Sitka spruce in Glentress Forest; these fungi may, however, be only of secondary importance.

(2) *European Larch.* The work on the fungus ecology of larch cankers is proceeding and one stage will be completed next year, when the data collected will be examined. During the year, it was agreed to collaborate with the Forestry Commission Research branch in the production of a bulletin on European larch.

(3) *Beech bark necrosis.* The work on this subject has reached a stage when it seems desirable to summarise the observations and experiments made to date. Mr. D. K. Barrett has been engaged on this and a report will be ready next year.

(4) *Soil conditions and the development of Sitka spruce.* Work is still proceeding on the descriptive soil data collected in the Pacific West Coast Forest in British Columbia in 1952: it is hoped that this will be finished next year.

Further observations are being made on the influence of soil conditions on the growth of this species in Britain, especially in closed plantations in high canopy. It is hoped, with the aid of a grant from the Forestry Commission, to examine during the summer of 1954 the development of this species in the older plantations in some countries of Western Europe where varying degrees of success have been obtained. The need for a clearer conception of the place of this species in British forestry economy, from the biological standpoint, is already clearly indicated: it is hoped that the tour will help to throw light on some of the pathological and silvicultural problems which are now arising.

(5) *Other items.* Various exhibitions, principally of photographs, have been arranged during the year for instructional purposes. Mr. Woodward and Mr. J. S. Shaw are thanked for their help in the preparation of these.

There have been a number of minor enquiries, most of which have been dealt with by Mr. F. H. Jones.

The technical assistants have again given loyal and intelligent service. The field work of investigating the bark disease of Douglas fir at Dymock has been in charge of Mr. F. H. Jones. Mr. D. K. Barrett has been responsible for the field work on European larch and beech; his work on the anatomical investigation of bark diseases, mentioned above, deserves particular mention. Miss Penn has given very satisfactory service during her first year here.

FOREST ENTOMOLOGY

Mr. G. H. Thompson continued in charge of this Section in which no staff changes occurred.

Teaching. The usual course of sixteen lectures in Forest Zoology, together with field demonstrations, was given to the junior year. A

course of eight lectures in Animal Ecology was also given to the junior year to replace the course hitherto given by the Bureau of Animal Population. Three men of the final year attended the advanced course in Forest Entomology.

Research. Progress was made with the compilation of a preliminary insect/host-tree list for the Gold Coast.

The first annual analysis was made of ash and sycamore billets laid down in 1953 in Wytham Wood for the study of insect succession. The bark of both species of billet was fairly loose but the wood was sound except for limited surface penetration by fungi. The fauna comprised mainly Nematodes, Collembola and Dipterous larvae on, in and under the bark. The ash billets contained many broods of the barkbeetle, *Hylesinus fraxini,* and a few *H. crenatus* larvae.

Ecological studies were begun on woodwasps of the genus *Xiphydria* and their parasites. An Ichneumon parasite, *Pseudorhyssa sp.* new to Britain, was found in association with *Xiphydria camelus.*

In July, a survey of the insects associated with alder (*Alnus glutinosa*) was conducted on behalf of the Nature Conservancy in the Grange area of the Lake District.

Further work on insect defoliation and its effect on tree growth awaits the provision of insectary and other facilities.

MANAGEMENT

There was no change in the general organisation of the courses in forest management, which consist in the first year of twenty-four lectures, four weeks practical work in the New Forest, and a tour in Normandy and the Landes: and in the second year, sixteen lectures, two weeks practical in the New Forest and a tour in the French and Swiss Jura. The lectures were given by Mr. N. V. Brasnett and Mr. T. E. Edwardson. Thanks in no small degree to the text-book on forest management by Mr. Brasnett published during the year, it was found possible to devote more time to description and discussion of actual working plans and the results which have been achieved from them. The recent publication of summaries of a Swiss plan and several American ones enabled these to be included with French, Indian and Colonial examples.

The area in the New Forest which had to be described and enumerated in September 1953, was 513 acres. Much of the tract carried rather poor maturing hardwoods and presented a typical problem of rehabilitation for ultimate sustained yield production from hardwoods and conifers on their appropriate sites. The preparation of a long-term scheme, as a profitable undertaking for the owner, with the detailed prescriptions for the first ten years was undertaken in March, 1954.

Supervision and assistance were given to post-graduate students making special studies of various aspects of management; viz. management of pine forests under resin tapping; forest grazing, its

effects, management and improvement; management of forests in the United Kingdom; and forest rights in Eastern Nigeria.

The request of the British Commonwealth Forestry Conference that the Institute should collect, summarise and publish all available Commonwealth procedures and experience in maintaining records of convenient management units was complied with. The procedures of fifty departments were condensed and collated in an Institute paper which was published at the end of the year.

MENSURATION

Teaching. The usual undergraduate courses including practical work in Bagley Wood, were given by Mr. Edwardson. An advanced course on selected points in mensuration was given to post-graduate students. A permanent sample plot of *Thuja plicata* in Bagley was re-measured and a new plot was laid out in 20 year old European larch, also in Bagley Wood. In both cases the Forestry Commissioner's Mensuration Branch gave much appreciated assistance.

Research. Mr. Edwardson, helped as before by field parties provided by the Deputy Surveyor, Forest of Dean and the Forestry Commission Mensuration Branch, completed a ten per cent random plot enumeration of both hardwoods and conifers in the Highmeadow Woods (Glos.). The analysis of the collected data was done by Dr. Sampford.

Complete enumeration of two Chiltern beechwoods on the Parmoor estate, totalling nearly 50 acres, was done by Mr. Edwardson and the silvicultural assistant to provide data needed for the visit of the British Association to the woods in September 1954.

Mr. Edwardson visited the Forest School at Freiburg, Germany, to discuss with Dr. M. Prodan the problems of periodic inventory in even-aged crops.

Supervision was given to the advanced studies by Mr. C. S. Howroyd on the use of aerial photographs in the determination of growing stock volumes in tropical evergreen forests in Borneo, by Mr. R. M. Waters on the preparation of commercial volume tables for *Chlorophora excelsa* in Tanganyika, and by Mr. R. C. Steele on an appreciation of the literature on aerial photography likely to be of particular value to foresters.

STATISTICS

Mr. J. M. Hammersley again gave a course of lectures on elementary statistics for Forestry students.

Mrs. Allington's work has continued satisfactorily and her services in computing have been in good demand by various members of the staff and some senior students. She has also continued to give part-time service in the Department's general store, under Mr. F. H. Jones.

WOOD SECTION

Dr. L. Chalk continued in charge of the section. The usual undergraduate and post-graduate courses were given. One Diploma student and two Forest Officers carried out advanced studies in this subject, which was also chosen as their optional 'Special Subject' by four undergraduates.

Research. (1) *Thailand Timbers.* Mr. T. Sriburi carried out an investigation into the identity of species of *Anisoptera* being imported into the U.K. as 'Krabak'. Commercial material examined was all of *A. oblonga* Dyer. The wood of this species contains notably fewer crystals than the other likely species. He also compared a number of other timbers exported from Thailand with timbers from the same genera imported from other countries. The first part of this work was done at the Forest Products Laboratory, Princes Risborough.

(2) *Nigerian Timbers.* Mr. J. F. Pollard prepared a 'punched card' key to common Nigerian timbers and also a simplified written key with line drawings illustrating the diagnostic features of each timber. He also made a study of the past attempts to market Nigerian timbers in the U.K.

(3) *Sierra Leone. Gmelina arborea* as a possible match splint timber. Mr. J. E. F. Douay devised and carried out tests with a small pendulum machine operating on approximately match-splint sized specimens. Comparison with *Bombax malabaricum* from India showed the *Gmelina* to have a slightly higher breaking strength.

(4) *Sitka Spruce.* (*a*) *Moisture in the living tree.* These experiments failed to give conclusive confirmation of the seasonal changes observed by Craib, but indicated that the water content is markedly lower in slightly suppressed trees and in all trees on dry sites; the amount of wood on the outside that is completely saturated appears to be very small indeed. (*b*) *Variation in the stem.* Mr. J. A. Kininmonth investigated variation in relation to sampling, concluding that for ordinary comparative purposes samples should not be taken from the lower 5 ft. of the stem or from within 10-15 rings of the pith. He also attempted to analyse the anatomical differences associated with variations in density, and found closer correlation with mean tracheid widths and wall thickness than with macroscopic characters such as ring width and percentage of late wood. These macroscopic characters varied outwards from the pith.

(5) *Variation in Fibre Length.* Mr. E. B. Marstrand investigated fibre length in a storied wood, *Pterocarpus angolensis,* to check the hypothesis that the increase in fibre or tracheid length outwards from the pith that occurs in many woods is associated with transverse divisions of the fusiform cambial initials. In *Pterocarpus* the divisions are longitudinal and no appreciable increase in length was observed after the first ring. Length rose to a maximum in the middle of each ring.

(6) *Differential shrinkage*. Mr. R. M. Barclay studied the possible influence of anatomy on the tangential shrinkage of 12 woods selected for their differing shrinkage values. The results indicated the possibility of a positive relation between the area of vessels and tangential shrinkage and a negative relation between percentage of ray tissue and tangential shrinkage.

The Wood Collection. The principal additions to the wood collection were from the Colonial Forest Departments of the British Solomon Islands, Fiji and Tanganyika, and from Israel, New Zealand and Thailand.

The British Commonwealth Forest Terminology, Part II. Dr. Chalk has been responsible for revising the terms concerned with wood anatomy.

FOREST ECONOMICS

Mr. J. J. MacGregor continued in charge of this section with Mr. F. E. Balman as his assistant. Mr. A. M. Simpson left at the end of June to take up a permanent appointment in the Forestry Service of Northern Ireland. His place in the Survey of Private Forestry Costs for England and Wales has been taken by Mr. T. W. Irvine. The secretarial duties of the section have been performed by Mrs. J. F. Darby.

Teaching. Courses of lectures and tutorials were provided for the Honour School of Forestry on general economic theory, forest economics, and the optional subject of British Forest Law, Land Tenure and Taxation. Seminars, based on a study group who examined the main economic problems having a bearing on the forestry of three colonial regions, were arranged for the Colonial Forest Officers.

Research, etc. (1) *Survey of Private Forestry Costs*. This continues to be the main item of research in this section. Over seventy estates scattered over England and Wales are now co-operating with this section in the provision of economic data. The Second Annual Report on this survey covers the two years 1951/52 and 1952/53.

(2) *Study of prices and supplies*. An article on Timber Statistics was published in the Journal of the Royal Statistical Society as one of a series on 'The sources and nature of statistical information in special fields of statistics'.

(3) *Other items*. Some study was made of the French post-war forest policy and, in particular, of the methods of providing assistance to private woodlands. At the request of the editor of the Committee of the Finnish Forestry Society, an article was prepared on the British Forest Economy and Policy for a special issue of *Acta Forestalia Fennica* to mark the 60th birthday of Professor Saari of Helsinki. In July 1954 a memorandum on some suggestions for the improvement of home-grown timber marketing was prepared and submitted to the Departmental Committee on the Marketing of Woodland Produce.

Mr. MacGregor also attended a discussion at the Privy Council Office when Monsieur Morel of the French Forestry Service explained some of the current problems of French forestry.

FOREST LAW

As in the previous year, lectures on the Law of Evidence and of Contract were given to the officers' course by Mr. F. E. Davis of New College.

COLONIAL FOREST ADMINISTRATION

Mr. N. V. Brasnett gave twelve lectures and some tutorials on the various aspects of forest administration in the colonies to those students who elected to take the optional paper on the subject in the Final Honour School.

In the Forest Officers' course discussions, at which each acts once as leader and once as secretary, with the duty of preparing a brief summary of the discussions, were held during the Michaelmas and Hilary Terms. These discussions, supervised by the Professor and other members of the staff, provide training in the handling and reporting of meetings. The subjects to be discussed were chosen by the officers, and those concerned with administration were (1) the selection and reservation of forests, (2) the training of local technical staff, (3) Local Government forestry, (4) control of grazing, (5) village and farm forests, (6) problems of forest labour, and (7) organisation of township fuel supplies.

FOREST UTILISATION AND ENGINEERING

The usual course of lectures in forest utilisation and engineering was given to first and second year students by Colonel A. H. Lloyd who continued in charge of the Section. Field work included road alignment and small timber bridges. Colonial forest officers and probationers were given a short course of lectures on timber grading, extraction and sawmilling. A practical course on the sharpening and maintenance of pit-saws and cross-cut saws was given in the Institute workshops.

Colonial forest officers have frequently asked for a course on the maintenance of motor vehicles, and practical instruction was arranged this year at the local workshops of the Royal Electrical and Mechanical Engineers (T.A.) where a course of eight lectures and practical demonstrations on vehicle maintenance was well attended.

Five lectures on various aspects of utilisation were given by visiting lecturers to Colonial Forest Officers and students. Each lecture was followed by a general discussion. Extraction and logging of tropical timber in West Africa was described by the United African Company (Timber) Ltd. Conversion and sawmilling were dealt with by Mr. W. Skinner, Director of Messrs. Skinner and Richards, Ltd., Liverpool, and by Mr. Stodart, Manager of Messrs. Stenners of

Tiverton, Ltd. Mr. B. J. Rendle, Forest Products Research Laboratory, Princes Risborough, gave a lecture on Tropical Timbers and United Kingdom Markets, and Mr. L. G. S. Hebbs, of Messrs. Cross and Bevan, dealt with the Wood Pulp Industry in the Tropics.

A short course of lectures and demonstrations at the Forest Products Research Laboratory, Princes Risborough, was attended by forest officers, probationers and final year students. Discussions were also arranged between the forest officers and the research staff in charge of the various sections of the Laboratory.

Messrs. Glikstens' timber yards and sawmills were visited at Stratford where the conversion of imported tropical timbers and kiln seasoning in their recently installed modern seasoning kilns were demonstrated. Timber conversion was also studied at the Plumridge Sawmills at High Wycombe.

A demonstration of felling by chain-saw and tractor logging was held at Bagley Wood, near Oxford, during the Summer Term. A track-laying tractor and new type of logging arch and loading were demonstrated by Messrs. Boughton and Sons Ltd. of Amersham Common. Loading and hauling by Unipower four-wheel-drive tractor and timber trailer was also shown. Haulage on a Norwegian timber sledge was demonstrated by the Ferguson Tractor Company which also displayed mechanical post-hole digging and a new type of portable saw-bench. The breaking-down of timber into planks on the felling site was shown by the Avon Power-Saw Company, and tree felling by the Teles chain-saw.

The use of a Skyline Crane and cableway for timber extraction was demonstrated in Switzerland to forest officers and probationers during their Continental tour.

In the Easter vacation the Forestry Commission Timber Depot at Thetford was visited and students were shown methods of grading, handling and loading small size material. Thanks are again due to Mr. Gordon Jacob at Chester for receiving a number of our forest officers individually and demonstrating the conversion and use of conifer thinnings. Mr. Gordon Jacob's sawmill at Queen's Ferry has become a centre of interest to many visiting forest officers studying up-to-date methods of conversion and utilisation.

FOREST PROTECTION

A course of lectures in fire protection and counter-erosion work was given to first year students and fire protection methods were studied in the Thetford forest where the Commission demonstrated the very intensive system of fire protective measures.

SURVEYING

The usual surveying course was given in the Trinity Term by Major-General R. Ll. Brown.

The course in aerial survey was again given to the post-graduate students by Mr. A. R. Robbins, University Lecturer in Surveying, and in air-photo interpretation by Dr. G. W. Dimbleby.

LIBRARY

Miss G. Guiney continued to be in charge of the Library, with Mr. Hemmings and Mr. Dieneman as assistants.

Statistical data for the year, with comparative figures for the previous year in brackets, are:

Accessions:

Issues of periodicals	1,944	(1,975)
Books	200	(170)
Other items	1,944	(1,750)
Total	4,088	(3,895)

Three entomological books (1) were purchased through the Brooks Memorial Fund. The Commonwealth Forestry Bureau deposited 442 (330) items, and in response to direct requests to other institutions we received 230 (234). The marked increase in the amount of material coming through the Bureau is partly accountable to an exchange arrangement recently made between the Commonwealth Agricultural Bureaux and the United States Department of Agriculture; the Washington publications on forestry subjects are allocated to the Oxford Bureau and so come to the library on deposit. A further increase may be expected when a full year's figures can be shown. The long-existing direct exchange between the library and Washington, inevitably attenuated since 1939, is thus to some extent superseded.

Loans:

To staff: direct, 779 (838); in circulation, 2,313 (2,075)	3,092	(2,913)
To students	1,803	(1,890)
To Bureau staff	537	(591)
To visitors and correspondents	540	(578)
Total	5,972	(5,972)

New Periodicals. Eighteen: 3 British, 2 international, 2 Mexican, 2 German and one each from Algeria, Austria, Chile, Hungary, Norway, Sweden, Switzerland, Thailand and the United States of America.

New Series. Ninety-two sets of reports, bulletins and miscellaneous items of official provenience have begun coming from 39 different sources, including Alaska, Egypt, French West Africa, Honduras, Japan, Jordan, Latvia, Libya, Luxembourg, Poland, Syria, Taiwan, and the U.S.S.R.; amongst these are Inter-African and international organisations.

Correspondence. Letters sent, 1826 (1892); received, 1023 (1131). Requests decreased during the latter part of the year as those usually addressed to Washington became unnecessary when the exchange referred to above began.

Sales. Receipts were reduced to £128 18s. (£154 3s. 3d.), owing to the method of accounting which now shows only the sale of our own publications, either in the library or (chiefly) by post. The sale of publications from other sources, bought for re-sale to students, is thus concealed. The useful practice of accepting second-hand text-books from departing students for disposal to newcomers is growing, but the money received is paid direct to the owners. The official sales are handled by the library typist.

Catalogue Room. The card index catalogue suffered another set-back as the introduction of a revision of the 'Oxford' classification adopted in 1953 by the Bibliographical Committee of F.A.O., Rome, necessitated many alterations to existing cards. This task is still some way from being completed, but 21,587 (~~13,207~~) cards were dealt with under the Oxford scheme, and 936 (1,478) under the Flury system.

The catalogues were also used to an increasing extent by staff and students, and by visitors from other countries where such facilities are lacking.

Gifts. Welcome additions to the library have been made by numerous generous donors, amongst whom may be especially mentioned Mr. Bruce Campbell (Secretary to the British Trust for Ornithology) who gave us a copy of the rare *Treatise on Forest Trees,* by W. Boutcher, Edinburgh 1775, signed by the author; Miss D. B. Dew, Lower Heyford, for *A Treatise on Dry Rot* by A. Bowden, 1815, received through Dr. Hassall of the Bodleian; Dr. S. Inal of the University of Istambul for an inscribed copy of his new book on the *Valonda Oak Forests;* Mr. D. R. Rosevear for a copy of his book, *Vegetation, Forests and Wild Life in Nigeria,* 1953. Mr. L. Wigg for a copy of the *Proceedings of the Association pour l'Etude Taxonomique de la Flore d'Afrique tropicale,* 1951; Mr. R. Marsden for three of the more important works by the late Professor Troup; Mr. James Macdonald for the 2nd (folio) edition of *The Construction of Timber,* by J. Hill, 1774 (the library already possessed the first edition 1770 bought a few years ago for a few shillings and recently advertised at £17); The Director, Escuela Superior de Ingenieros de Montes, Madrid, and the Director, Instituto forestal de Investigaciones y Experiencias, Madrid, for some particularly interesting books.

An oil-painting, 'The Open Door', by Mrs. Hilda Harrison, and three reproductions of eighteenth-century flower paintings by G. Ehret, were purchased as part of the gift made by Mrs. Aspin in memory of Isabel Aspin, formerly Assistant Librarian.

PHOTOGRAPHIC SECTION

The Photographic Section, staffed by Mr. H. F. Woodward and one assistant, has during the past year processed 3,840 (5,575) prints and enlargements, including a number of special prints for the British

Association Exhibition, 732 (1,258) negatives, 163 (162) lantern slides, and has taken 275 (379) photographs and photomicrographs. Assistance has also been given to research workers by supplying such requirements as photographic stencils, measuring graticules, a hair-line centre disc for a microscope eyepiece, as well as by repairing iris diaphragms and the automatic timing mechanism of a centrifuge.

The new lantern slide card index is now in operation and is proving very useful. Repairs and additions to the print collection have continued and some further classification into sub-sections has been done.

The section also maintains and operates the projection equipment for lectures, etc. An Aldis 2 in. by 2 in. projector has been purchased and greatly improves colour projection in the smaller lecture rooms.

The Duplicating work has increased considerably and with the printing of the Forests Economics Survey, has amounted to 98,000 (50,000) impressions. A considerable number of graphs and illustrations in colour, and the Library Bulletins, have also been printed on a Fordigraph machine operated by the section.

WORKSHOPS

The Workshops continued with 2 metal-workers, Mr. E. J. Howell, and Mr. G. A. Jones, and one wood-worker, Mr. J. Howkins.

Major construction in the year included:

Woodwork:

(1) Book stack for working plans in *Mlanje* Cedar.
(2) Index filing cabinets (3) twelve drawers each—made in *Ramin.*
(3) Furniture for Projection Room.
(4) Plate-glass doors in Mahogany room—library.
(5) Eight Entomological breeding cages.
(6) Glass fronted bookcase and cupboard in *Red Meranti.*
(7) One hundred wood specimen storage boxes.

Mr. Howkins also attended a course in saw maintenance at Spear & Jackson, Ltd., Sheffield, and gave useful demonstrations and instruction in this technique to interested students.

Metal Work

(1) Circular Saw—for the precision cutting of perspex.
(2) Two moulds for the construction of perspex trays.
(3) Twelve spring tubular balances for the measurement of wood growth.
(4) Izod Impact Tester.
(5) Stainless steel stirring rod and paddle blades.
(6) Cowling for Muffle furnace.
(7) Constant temperature bath.
(8) Three Diameter gauges.
(9) Twenty Brass ' leaf borers '.
(10) Tree sword.

H. G. Champion
Professor of Forestry

APPENDIX I

PUBLICATIONS

GENERAL

Original Publications

Forestry, by H. G. Champion. Oxford University Press (Home University Library), 1954.

Forestry in Great Britain, the Commonwealth and Europe during 1953, by A. H. Lloyd. *Encyclopaedia Britannica 'Book of the Year'.*

Reviews

Woodland Management, by W. E. Hiley. *Forestry,* XXVII: 149-52 (*H. G. Champion*).

Trees: The Year Book of Agriculture 1949, U.S. Dept. of Agriculture. *Empire Forestry Review,* 32:264 (*N. V. Brasnett*).

Forest Policy: Tanganyika Seasonal Paper No. 1, 1953. *Empire Forestry Review,* 32:257-9 (*N. V. Brasnett*).

Administrative Reports: Nyasaland, 1952; Tanganyika, 1952. *Empire Forestry Review,* 33:93-5 (*N. V. Brasnett*).

SILVICULTURE

Original Publications

Applied Forest Ecology, by E. W. Jones. *Quarterly Journal of Forestry,* 48:24-8.

Root Systems of Ash and Sycamore Seedlings, by A. Majid. *Journal of Oxford University Forestry Society,* Fourth Series 2:25-6 (*Edited by L. Chalk*).

Reviews

Studies in British Beechwoods, by J. M. B. Brown. Forestry Commission Bulletin, No. 20, 1953. *Forestry* XXVII: 152-5 (*E. W. Jones*).

Experimental Pruning of Douglas Fir in British Columbia, by J. M. Finnis, B.C. Forest Service Research Notes, No. 24, 1953. *Empire Forestry Review,* 32:370-1 (*N. V. Brasnett*).

Regeneration of Tropical Forests: Papers in Bois et Forêts des Tropiques, 27, 28, 29, 32, 1953. *Empire Forestry Review,* 33: 86-8 (*N. V. Brasnett*).

The Tropical Rain Forest, by P. W. Richards, 1953. *Empire Forestry Review,* 33:134 (*H. G. Champion*).

ECOLOGY

Original Publications

A simple method for the Comparative Estimation of Soil Water, by G. W. Dimbleby. *Plant and Soil,* 5:143-159.

The Origin of Heathland Podzols and their Conversion by Afforestation, by G. W. Dimbleby. *Reports and Communications* (*Sect.* 13) *VIIIth International Congress of Botany*, 1954.

The Growth and Mineral Nutrition of Spruce and Pine in Heathland Plantations, by L. Leyton. *Institute Paper No.* 31.

The Concept of Physiological Age, by K. Tisseverasinghe. *Journal of Oxford University Forestry Society*, Fourth Series 2:9-12. (*Edited by L. Chalk*).

The Edge Effect in Nursery Beds, by J. D. Whitaker (summarised by L. Leyton), *Journal of the Oxford University Forestry Society*, Fourth Series 2:22-24. (*Edited by L. Chalk*).

Review

Le Tapis végétal dans ses rapports avec les phénomènes actuels de surface en Basse Provence (de Cassis à Bandol), by G. Kuhnholtz-Lordat. *Encyclopedie biogeographique et écologique*, IX. 1952. *Journal of Ecology*, 42:221-2 (*E. W. Jones*).

BOTANY

Original Paper

Studies in Systematic Botany, 1949-53, by A. C. Hoyle and F. White. *Journal of Oxford University Forestry Society*, Fourth *Series* 2:25-26.

PATHOLOGY

Original Publications

The growth of Sitka Spruce on Shallow Soils, in Relation to Root Disease and Wind-throw, by W. R. Day. *Forestry*, XXVI: 81-95.

Drought Crack of Conifers, by W. R. Day. *Forestry Commission Forest Record*, No. 26, 1954: 1-40.

Poplar Canker and Frost, by B. E. St. L. Stuart. *Journal of the Oxford University Forestry Society*, Fourth Series 2:13-17. (*Edited by L. Chalk*).

Unpublished Reports for the Forestry Commission:

Resin Flow from Douglas Fir in Compartment 2, *Dymock Forest*, by W. R. Day.

Main Stem Injuries to Japanese Larch at St. Gwynne Forest, by D. K. Barrett.

FOREST ENTOMOLOGY

Original Publications

Ambrosia Beetles in Forest and Sawmill, by R. C. Fisher, G. H. Thompson and W. E. Webb. *Forestry Abstracts*, 14:381-9 and 15:3-15 (Leading article).

FOREST MANAGEMENT

Original Publications

Planned Management of Forests, by N. V. Brasnett. Allen & Unwin, 20s.

Management Records: the Maintenance of Histories of Forest Management in the British Commonwealth, by N. V. Brasnett. *Institute Paper, No.* 30.

Irregular Forestry, by H. G. Champion. *Quarterly Journal of Forestry*, 48:55.

WOOD STRUCTURE

Original Publication

False Rings in Larch, *Larix decidua* Mill., by T. K. Foote. *Journal of Oxford University Forestry Society*, Fourth Series 2:5-8. (*Edited by L. Chalk*).

FOREST ECONOMICS

Original Publications

Survey of Private Forestry Costs, England and Wales, by J. J. MacGregor. Second Annual Report for forest years 1951/52 and 1952/53, Imperial Forestry Institute, Department of Forestry, University of Oxford, June 1954. p. 98.

The Sources and Nature of Statistical Information in Special Fields of Statistics—Timber Statistics, by J. J. MacGregor. *Journal of the Royal Statistical Society*, Series A (General), Vol. CXVI, Part III: 298-322.

Some Suggestions for the Improvement of the Marketing of Home-grown Timber, by J. J. MacGregor. A memorandum submitted to the Departmental Committee on the Marketing of Woodland Produce. p. 16.

The British Forest Economy and Policy, by J. J. MacGregor. *Acta Forestalia Fennica*, 61:1-15 (Helsinki).

France's Post-War Forest Policy, by J. J. MacGregor. *Quarterly Journal of Forestry*, XLVIII: 167-78.

Reviews

A series of articles covering certain sections of *European Timber Trends and Prospects*, United Nations, Geneva 1953, was published in *Wood* under the following titles:

(i) European Timber, by J. J. MacGregor. *Wood*, 18: 218-21.

(ii) Europe's Wood Consumption in Housing and Construction (1), by J. J. MacGregor. *Wood*, 18:256-8.

(iii) Europe's Wood Consumption in Housing and Construction (2), by J. J. MacGregor. *Wood*, 18:294-5.

(iv) European Timber Requirements for Mining. By J. J. MacGregor. *Wood*, 18:339-41.

(v) European Wood Consumption and Communications, By J. J. MacGregor. *Wood,* 18:392-3.

(vi) Wood Consumption in Packaging, by J. J. MacGregor. *Wood,* 18:425-7.

Research in the Economics of Forestry, by W. A. Duerr and H. J. Vaux. Editors: Charles Lathrop Pack Forestry Foundation, Washington D.C., 1953. p. 475. *Empire Forestry Review,* 32:261-3. (*J. J. MacGregor*).

Elements of Forest Economics, by Sven Petrini, translated by Professor M. L. Anderson, *Empire Forestry Review,* 32:366-8. (*J. J. MacGregor*).

Taxation and Other Factors Affecting Private Forestry in Connecticut, by E. V. Zumwalt. *Empire Forestry Review,* 32:371-2. (*J. J. MacGregor*).

FOREST UTILISATION AND ENGINEERING

Original Publication

Extraction of Timber by Skyline Crane, by A. H. Lloyd. *Unasylva* VII: 159-60.

Reviews

Wire Skidding: Wood Transportation by Gravity over a Suspended Wire, by A. Koroleff and R. D. Collier. *Empire Forestry Review* 33:181. (*A. H. Lloyd*).

Mechanics of Sawing: Band and Circular Saws, by P. Harris. *Empire Forestry Review* 33:182. (*A. H. Lloyd*).

Forest Products Research and Industries in the United States, by W. W. Varossieau *Empire Forestry Review* 33:183. (*A. H. Lloyd*).

Use of Chutes for Extraction of Thinnings by R. G. Shaw, *Quarterly Journal of Forestry,* XLVIII: 68. (*A. H. Lloyd*).

The Production of Cellulose Pulp from Commonwealth Raw Materials: A Report from the Natural Resources (Technical) Committee Working Party on Pulp Production. Colonial Plant and Animal Products, III, 4, 1952-3. *Empire Forestry Review,* 33:186-7. (*N. V. Brasnett*).

APPENDIX II

STAFF

I. STAFF ENGAGED IN INSTRUCTION AND RESEARCH

Professor H. G. Champion, C.I.E., M.A., D.Sc. (Oxon.). Tropical Forestry, Forest Policy.
L. Chalk, M.A., D.Phil. (Oxon.). Wood Structure and Properties.
W. R. Day, B.Sc., M.A. (Oxon.). Pathology, Forest Hygiene.
A. H. Lloyd, O.B.E., M.C., T.D., M.A. (Oxon.). Forest Engineering and Utilisation.
E. W. Jones, M.A. (Oxon.), Ph.D. (Cantab.). Silviculture.
G. H. Thompson, B.Sc., M.A. (Oxon.). Forest Zoology, Entomology.
N. V. Brasnett, M.A. Dip. For. (Cantab.). Forest Management, Colonial Forestry.
T. E. Edwardson, M.A., (Oxon.), B.Sc. (For.) (Edin.). Mensuration British Forestry.
J. J. MacGregor, B.Sc. (Glasgow), M.S. (Wisc.), B.Litt., M.A. (Oxon.), Forest Economics.
W. R. C. Handley, M.A. (Oxon.), Ph.D. (Leeds). Microbiology.
L. Leyton, M.A. (Oxon), Ph.D. (Leeds). Tree Physiology.
G. W. Dimbleby, M.A., D.Phil. (Oxon.). Forest Ecology.
F. White, B.A. (Cantab.). Forest Botany.
A. Angus. B.Sc. (Edin.). Forest Botany.
P. J. Rennie, B.Sc. (Lond.). Soil Research.

II. STAFF OF OTHER UNIVERSITY DEPARTMENTS ASSISTING IN INSTRUCTIONAL WORK

A. C. Hoyle, B.Sc., M.A. (Oxon.). Forest Botany and Ecology.
E. W. Russell, M.A. (Oxon.), Ph.D. (Cantab.). Soil Science
G. R. Clarke, B.Sc., M.A. (Oxon.). Soil Science.
A. R. Robbins, M.A. (Oxon.). Surveying.
Major-General R. Ll. Brown, M.A. (Oxon.). Aerial Survey and Surveying.
J. M. Hammersley, M.A. (Oxon.). Statistical Methods

III. OTHER STAFF

Secretary: Miss H. M. Edwards
Assistant Secretary: Miss I. Blagrove
Accountant: Mr. A. A. Adams
Librarian: Miss G. Guiney
Assistant Librarians: Mr. W. W Dieneman, B.A. (Oxon), A.L.A.
Mr. E. F. Hemmings